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Mathematics 5

Length and Area

Learning Technologies Branch

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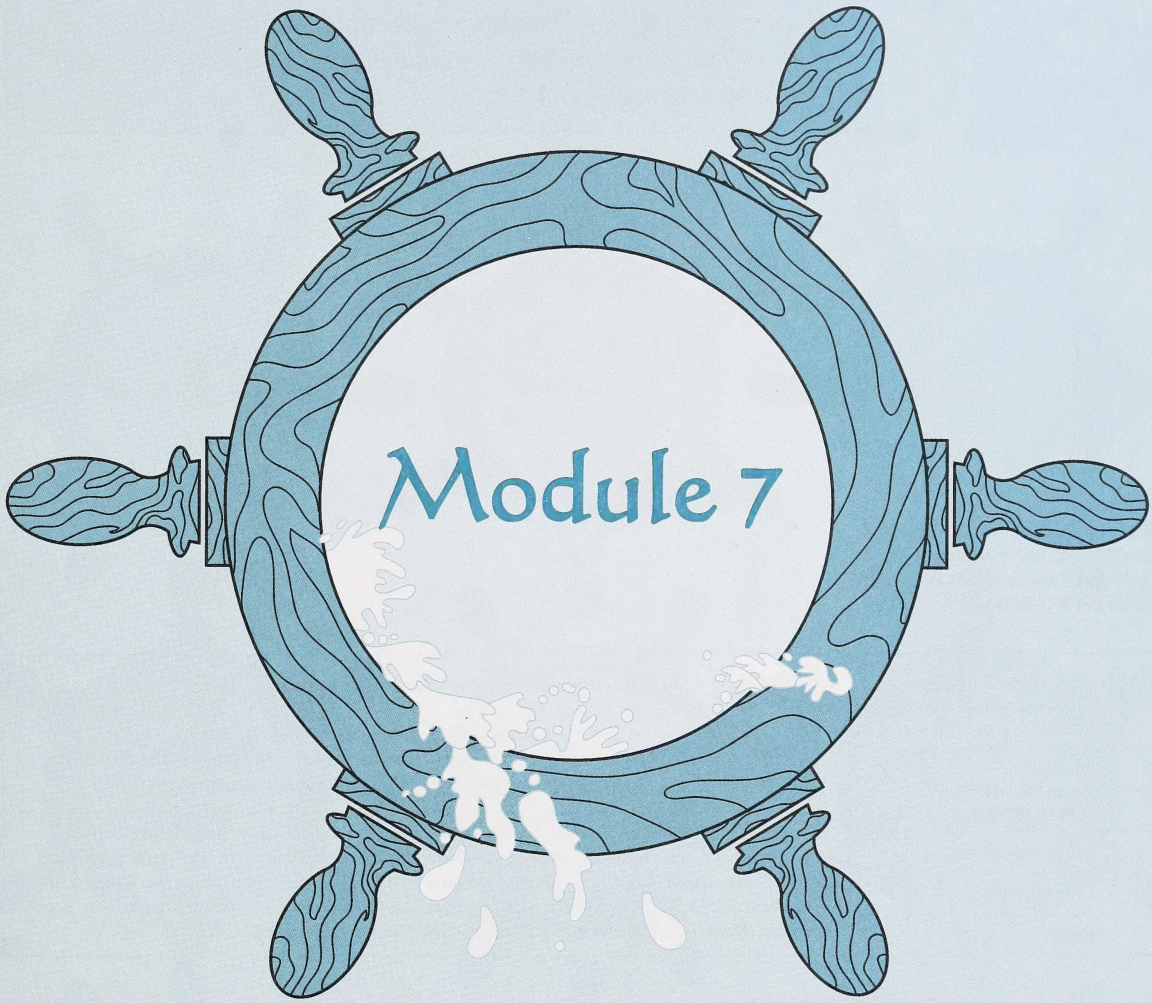
Mathematics 5



Length and Area

Learning Technologies Branch

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Mathematics 5
Module 7: Length and Area
Student Module Booklet
Learning Technologies Branch
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Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

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Welcome Aboard
Mathematics 5

Ahoy! Mathematics 5 contains nine modules.
You should work through the modules in order (from 1 to 9) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.

Module 1
Whole Numbers

Module 2
Patterns

Module 3
Fractions and Decimals

Module 4
Transformations

Module 5
Volume, Capacity, Mass, and Time

Module 6
Chance and Uncertainty

Module 7
Length and Area

Module 8
Data Analysis

Module 9
2-D Shapes and 3-D Objects

Adventures on the High Seas

Kassidy: Connor, guess what? I noticed an advertisement in the newspaper. A second-hand bookshop just opened, and it's supposed to have some really old books from all over the world.

Connor: Some may even be older than our great-grandparents! Let's go take a look.

Excited about what they might find to read, Connor and Kassidy hurry off to the bookshop.

Connor: Wow! Look at this, Kassidy. Here's an actual journal kept by Captain Quinn almost 300 years ago. It's kind of musty, and parts are hard to read, but look at how much math the captain used!

Kassidy: There are also maps, descriptions of ships, and reports about sea conditions.

Connor: Let's buy it. Figuring out what the journal says will be like unravelling a mystery. Maybe it will have clues about real buried treasure.

From time to time throughout the course, you will work with many of the facts and figures about the days of sailing boats and sea captains that Kassidy and Connor discover.

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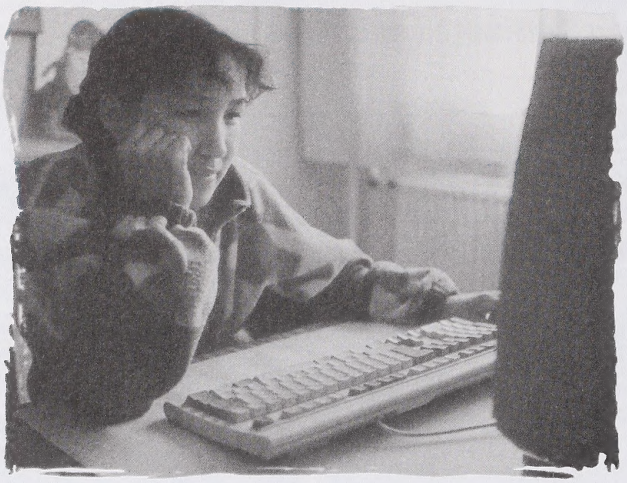
Course Features



BRYAN AND CHERRY ALEXANDER PHOTOGRAPHY

Take the time to look through the Student Module Booklet and the Assignment Booklets and notice the following design features.

- Each module has a Module Overview, Module Summary, and Review.
- Each module has several lessons. Each lesson focuses on a big idea that is central to the topic being learned in the module.
- Each lesson has several activities. An activity in each lesson is related to the high seas adventure theme. The last activity in each lesson is a Challenge Activity.
- Each module has a Glossary and an Answer Key in the Appendix. In several modules there are also special pull-out pages in the Appendix.
- Each module has special exercises that focus on certain mathematical skills. For example, The Numbers in the News project involves a scavenger hunt for samples of math in everyday life. The Keystrokes exercise introduces some "funky features" of the calculator that can be used to explore and practise important number ideas.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 5 textbook, *Quest 2000: Exploring Mathematics*, the soft-cover book *Quest 2000: Exploring Mathematics: Practice and Homework Book*, a basic four-operation calculator (such as the TI-108 calculator), and various manipulatives (base ten blocks and pattern blocks).

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.

Use your calculator.

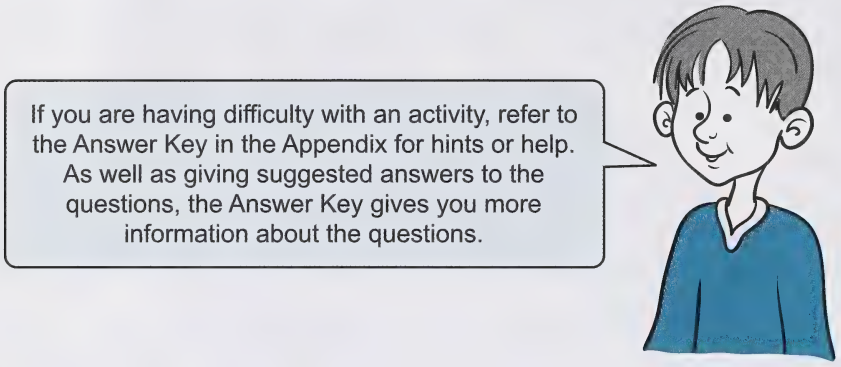
Use the Internet.

Refer to the textbook or the Practice and Homework Book.

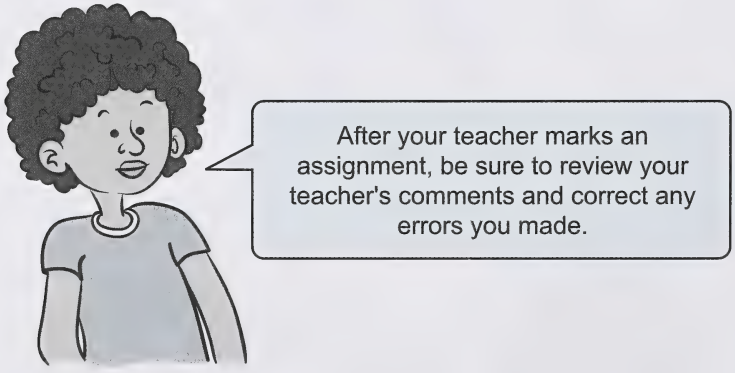
Your guides for this course are Kassidy and Connor.

Assessment and Feedback

The Mathematics 5 course is carefully designed to give you many opportunities to discover how well you are doing. In every activity you will be asked to turn to the Appendix to check your answers. Completing the activities and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.


If you are having difficulty with an activity, refer to the Answer Key in the Appendix for hints or help. As well as giving suggested answers to the questions, the Answer Key gives you more information about the questions.

Twice in each module you will be asked to give your teacher your completed assigments to mark. Your teacher will give you feedback on how you are doing.



There will be a final test at the end of the course. You can prepare for the final test by completing the Review at the end of each module.

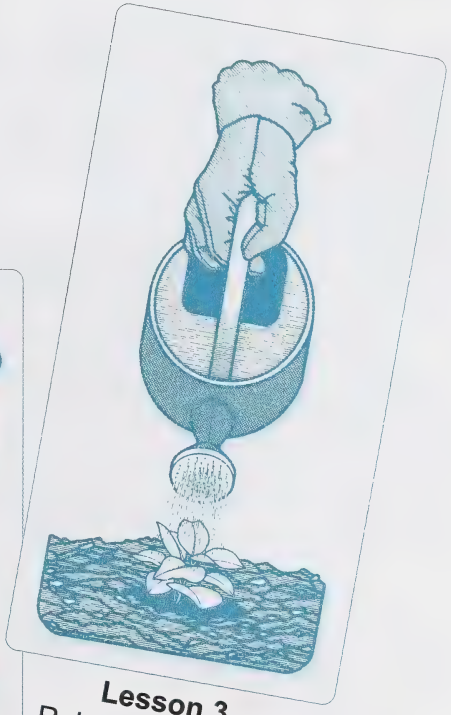
Module Overview

Kassidy and Connor decide to make a rectangular garden with straight rows of flowers and vegetables. (Look at the picture of the garden on pages 200 and 201 in your textbook.) They discover that they need to solve measurement problems like the following: If the garden is 3 m by 2 m, will 16 m of fencing enclose the entire garden? If a bag of fertilizer covers 5 m^2, will one bag cover the entire garden?

The three lessons in Module 7 will help you extend your understanding of measurement. You will use linear units to measure the length, width, height, depth, thickness, perimeter, and circumference of objects. You will learn techniques for estimating the perimeters and areas of irregular figures. You will explore the relationship between perimeter and area.

Lesson 1
Using Linear Units

Lesson 2
Finding the Perimeter
and Area of an Irregular Shape



Lesson 3
Relating Perimeter
and Area

Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 7A

Lesson 1 Assignment	30 marks
Lesson 2 Assignment	26 marks

Assignment Booklet 7B

Lesson 3 Assignment	34 marks
Numbers in the News	10 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 7A to your teacher before you begin Lesson 3. You will submit Assignment Booklet 7B to your teacher at the end of this module.

Numbers in the News

Numbers are everywhere! Newspapers and magazines are full of stories and advertisements that show how numbers are used every day.

The following Scavenger Hunt asks you to look through newspapers and magazines for samples of number ideas like those you will be using in this module. Read through the list now and begin by collecting samples of the ideas you already understand. You may collect other samples as you learn about them in the module. Collect as many samples as you wish.

Scavenger Hunt

Cut out articles or advertisements from newspapers or magazines that show measurement of length or area being used in different situations. Here are some suggestions of things to look for:

1. measures of length (using mm, cm, dm, m, or km) in different situations:
   – length
   – distance
   – height
   – depth
   – width
   – diameter or circumference

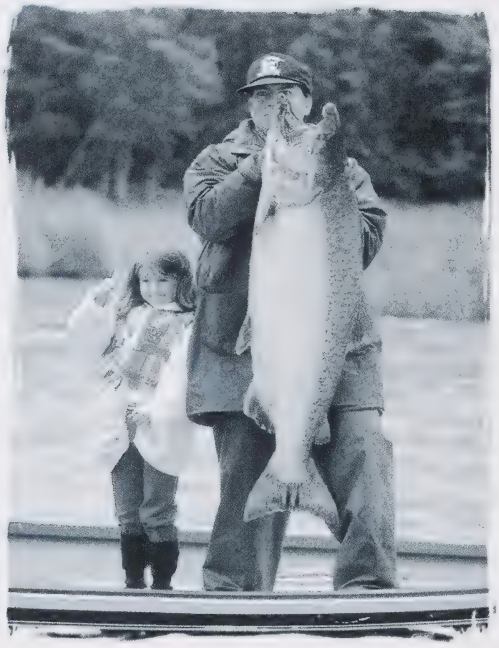
2. measures of perimeter given in mm, cm, dm, m, or km

3. measures of area given in mm^2, cm^2, dm^2, m^2, or km^2

You will find further instructions for submitting your project in Assignment Booklet 7B.

Lesson 1

Using Linear Units



Sharla enjoys fishing with her father. On their last fishing trip, they caught a salmon with a length of 110 cm and a girth of 79 cm.

Sharla and her father measured the length (the distance from nose to tail) and the girth (the distance around the middle) of the fish.

Measures of distance are called **linear measurements**. The units that are used are called **linear units**. You use linear units whenever you answer questions like these: How long is the pencil? How wide is the table? How deep is the hole? How high is the filing cabinet? How thick is the slice of cheese? How far is it to the grocery store? How much lace is needed for the edge of a tablecloth?

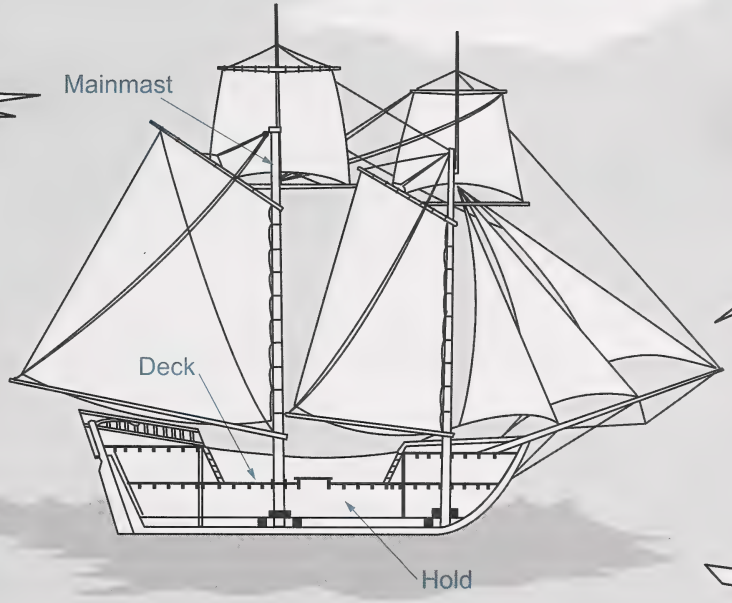
In this lesson you will review and extend your skills with linear measurement. You will use rulers, as well as metal and cloth measuring tapes. You will investigate how the Egyptians used ropes as measuring tools.

Activity 1

Today you will compare linear measurements.

Aye, I'm proud to be captain of the Estelle. She's a fine vessel that commands respect on the high seas. Her deck is wider and longer than the Bologne. Her mainmast is higher than the Catrina. Her hold is deeper than the Contessa.

-Captain Quinn



The following table shows the dimensions of various ships, including Captain Quinn's ship, the Estelle.

Name of Ship	Length of Deck (m)	Width of Deck (m)	Depth of Hold (m)	Height of Mainmast (m)
Bologne	31.70	10.06	4.88	24.69
Catrina	50.89	10.16	5.79	38.97
Contessa	29.87	9.45	4.57	23.47
Estelle	47.48	10.77	6.71	39.15
Florida	27.74	8.53	3.96	21.34
Genevieve	29.57	7.42	3.25	23.06
Rosa	23.50	7.19	3.81	18.33

1. **a.** Which ship had the longest deck?
   b. Which ship had the shortest deck?
   c. Which ship had the widest deck?
   d. Which ship had the second narrowest deck?

2. **a.** Which ship had the third deepest hold?
   b. Which ship had the shallowest hold?

3. **a.** Which ship had the highest mainmast?

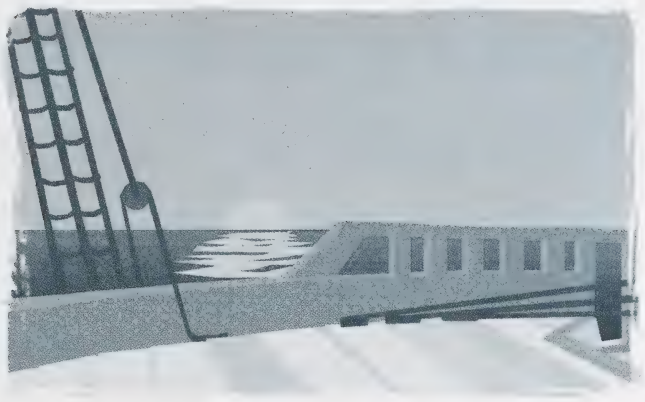
   b. Which ship had the second shortest mainmast?

4. Captain Swain said that his ship was about three times as long as it was wide. Which ship might have been his?

5. The captain of the Catrina boasted that no ship was larger than his ship. Do you think Captain Quinn would have agreed? Explain.

Check your answers on page 52 in the Appendix.

Captain Quinn asked his crew to measure the perimeter of the deck and the circumference of the mainmast.



Perimeter is the distance around a **polygon** (a figure with straight sides). **Circumference** is the distance around a circle.

6. Explain how perimeter and circumference are the same and how they are different.

Check your answer on page 52 in the Appendix.

Sharing Time

Now it's time to discuss with your home instructor what you have been learning.

1. Explain the meaning of length, width, height, thickness, depth, girth, perimeter, and circumference.

2. What kinds of measuring tools are used to measure each of the attributes in question 1? Why?

Your home instructor will help you check your answers.

Activity 2

Today you will increase your skills in estimating and measuring shorter distances.

Robbie and his friends enjoy building birdhouses and other carpentry projects. They have discovered that the saying "Measure twice and cut once" is wise.

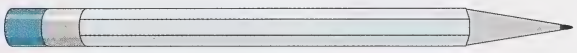
They also realized that it is a good idea to estimate before measuring. They found the following information helpful for visualizing a millimetre (mm), centimetre (cm), decimetre (dm), and metre (m):

- the thickness of a dime = 1 mm
- the width of a rod (in a set of base ten blocks) = 1 cm
- the length of a rod (in a set of base ten blocks) = 1 dm
- the height of a doorknob from the floor = 1 m

To measure length, perimeter, and circumference, you can use a metric ruler, cloth tape measure, metal tape measure, or wooden metre-stick. You can use string and a ruler to measure circumference.

Example

Use a metric ruler to find the length of this pencil. Give the measurement in centimetres and millimetres.

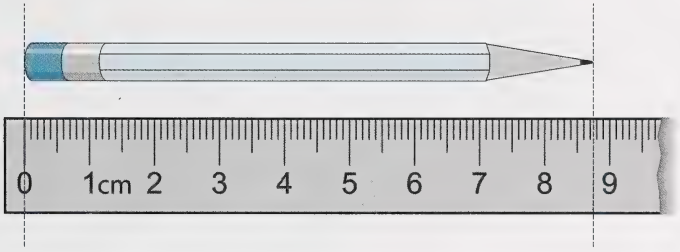


Step 1: Estimate the length of the pencil.

The pencil is a little less than the length of a rod from the base ten block set.

The pencil is about 1 dm or 10 cm long.

Step 2: Measure the pencil.



The pencil is between 8.7 cm and 8.8 cm. It is closer to 8.8 cm than 8.7 cm.

The pencil is 8.8 cm long.

1. Measure the length, width, and thickness of your textbook.

2. Turn to page 88 of the Practice and Homework Book and complete each row of the table except for the fourth, fifth, and eighth rows. (These rows do not involve linear measurement.)

Check your answers on page 53 in the Appendix.

Sharing Time

Now it's time to show your home instructor what you have been learning.

Turn to page 89 of the Practice and Homework Book and complete each row of the table except for the second row. (This row does not involve linear measurement.)

Your home instructor will help you check your answers.

Activity 3

Today you will compare the height and circumference of a cylinder.

For this activity you need to collect at least ten different cylindrical items. Try to find one item whose height is about half its circumference, one item whose height is about the same as its circumference, and one item whose height is about twice its circumference.

A few items are suggested in the following table.

1. Copy this table and complete it by listing your items. Then use a measuring tape to measure the circumference of each cylinder. Use a ruler to measure the height of each item. Record the measurements.

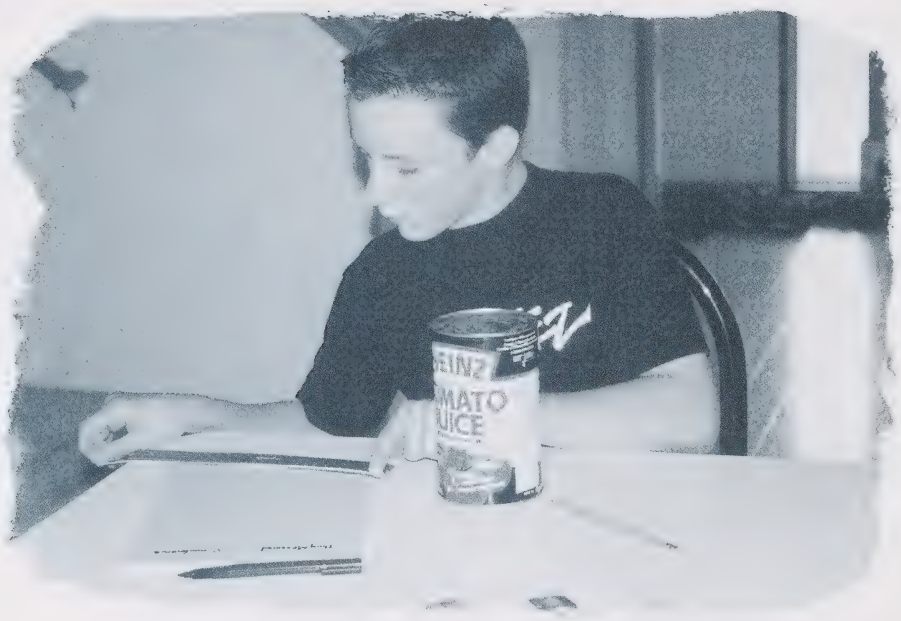
Container or Object	Circumference (cm)	Height (cm)
Soup Can (284 mL)		
Tuna Can (170 g)		
Glue Stick (25 g)		

2. Which items in your completed table have the following characteristics?

   a. The height is about half the circumference.
   b. The height is about the same as the circumference.
   c. The height is about twice the circumference.

Check your answers on page 54 in the Appendix.

Sharing Time



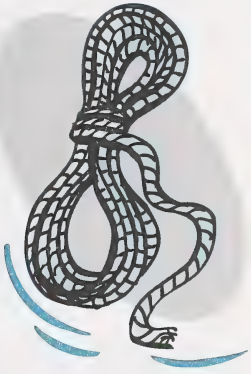
Now it's time to discuss with your home instructor what you have been learning.

Predict how the height and circumference for each of the following items will compare:

- a telephone pole
- a pizza pan
- a tennis ball can (one that holds three balls)

Your home instructor will help you check your answers.

Challenge Activity



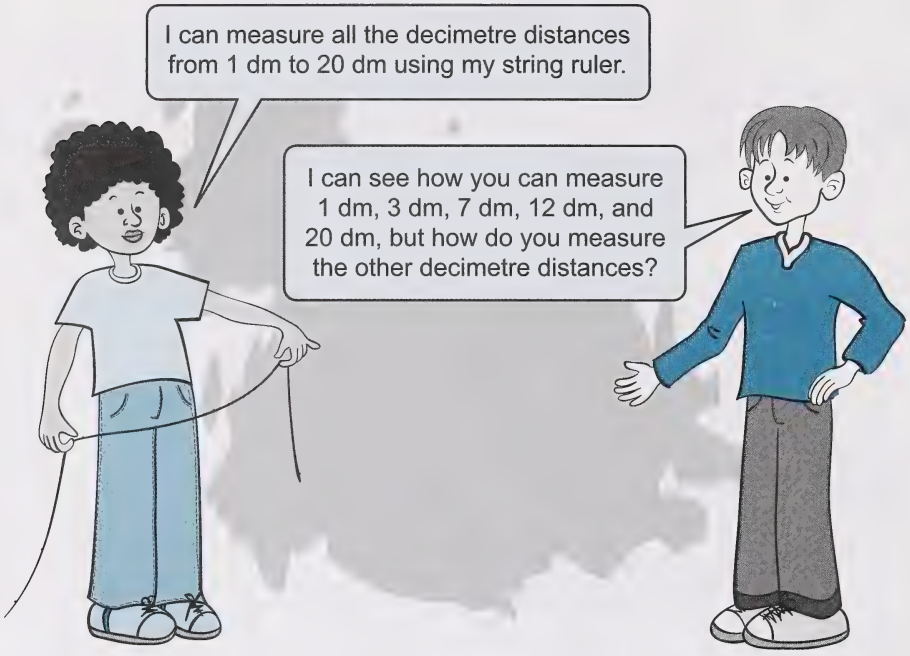
Have you ever wondered how the ancient Egyptians measured the dimensions of structures like the pyramids? The Egyptians used ropes as simple measuring tools. These early engineers and surveyors were called "rope stretchers."

Turn to page 216 in your textbook and read From Rope to Rulers.

1. Answer questions 1 and 3 on page 216 of your textbook.

Check your answers on page 54 in the Appendix.

Kassidy made a string ruler with knots at the following decimetre intervals: 1 dm, 3 dm, 7 dm, and 12 dm. She made the string ruler 20 dm long.


I can measure all the decimetre distances from 1 dm to 20 dm using my string ruler.
I can see how you can measure 1 dm, 3 dm, 7 dm, 12 dm, and 20 dm, but how do you measure the other decimetre distances?

2. Explain how Kassidy's string ruler can be used to measure each of the following decimetre distances.

a. 2 dm	**b.** 4 dm	**c.** 5 dm	**d.** 6 dm	**e.** 8 dm
f. 9 dm	**g.** 11 dm	**h.** 13 dm	**i.** 17 dm	**j.** 19 dm

3. Which decimetre distances from 1 dm to 20 dm can't be measured with Kassidy's string ruler?

4. Tell where Kassidy can tie two more knots so that all the decimetre distances from 1 dm to 20 dm can be measured with her string ruler.

Check your answers on page 55 in the Appendix.

Conclusion

In this lesson you reviewed and extended your skills with linear measurement. You estimated and measured length, height, width, depth, thickness, circumference, and perimeter. You used rulers as well as metal and cloth measuring tapes. You investigated how the Egyptians used ropes as measuring tools.

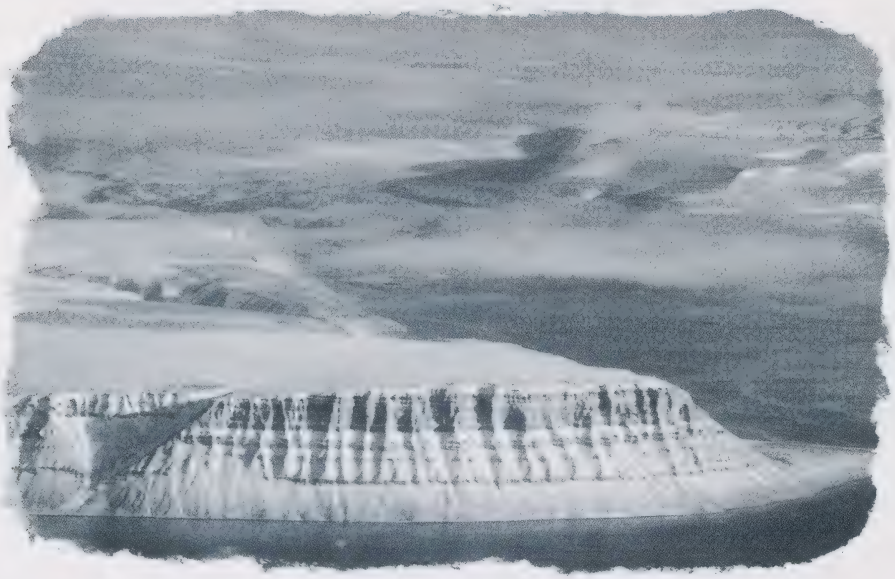
Did you know that there are acceptable height ranges for each breed of dog competing in a dog show? For example, a Jack Russell terrier should be between 30.5 cm and 38 cm in height. You don't measure a dog's height to the top of its head. Instead, you measure from the ground to the top of its withers (the highest point of the back above the "shoulders").

Turn to Assignment Booklet 7A and complete the Lesson 1 Assignment.

Keep Assignment Booklet 7A until you have completed the entire booklet.

Lesson 2

Finding the Perimeter and Area of an Irregular Shape



Many years ago, a meteorite crashed on Devon Island in Nunavut, Canada, creating a crater that measures 20 km in diameter. This crater is called Haughton Crater.

There is another interesting fact about Devon Island. It is the largest uninhabited island on Earth. It has a surface area of approximately 66 800 km^2 (read as square kilometres). How do you think the area of this irregularly shaped island was calculated?

In this lesson you will use several methods to find the areas and perimeters of irregular shapes.

Activity 1

Today you will explore various ways to find the area and perimeter of an irregular shape.

We were very excited whenever we encountered unfamiliar creatures while exploring uncharted islands. Our ship's doctor was most fascinated by these discoveries.
-Captain Quinn

On one trip, Captain Quinn's crew found unfamiliar footprints in the sand on an uncharted island.

The crew made sketches of the prints and recorded their perimeters and areas so the prints could be compared.

Perimeter is the distance around a figure. **Area** is the number of square units a figure covers.

Turn to pages 208 and 209 in your textbook and read Perimeters and Areas of Irregular Figures.

1. Use each of the three methods described in the textbook to find the approximate area of the footprint on page 208 of your textbook. Record your results.

2. **a.** Compare the approximate areas you got using the three methods. Comment on what you found.

   b. Which method do you like best? Explain.

Check your answers on pages 55 and 56 in the Appendix.

To find the approximate perimeters of the footprints, three methods are suggested on page 209 of your textbook. Notice that none of these methods trace around each toe. Because of the way the string is looped around the footprint, the answers you get will really be measures for the perimeter of a "sock print" (rather than a footprint made from bare feet).

3. Use each of the three methods to find the perimeters of the prints on page 209 of the textbook. Record your results. (**Hint:** Use the grid units shown in the pictures to measure the length of your string.)

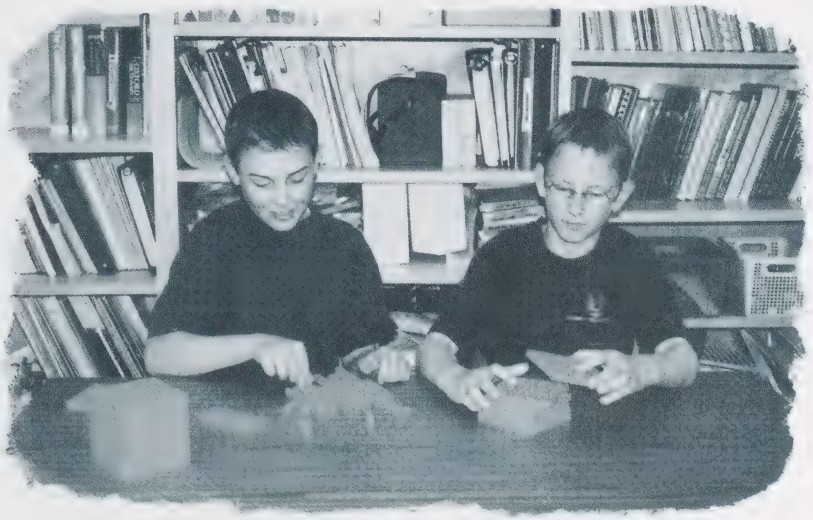
4. **a.** Compare the approximate perimeters you got using the three methods. Comment on what you found.

   b. Which method do you like best? Explain.

Check your answers on page 56 in the Appendix.

Activity 2

Today you will find the approximate area and perimeter of an irregular figure.



You can use base ten blocks as references when you estimate smaller areas. Take out a set of base ten blocks and lay them on the desk in front of you. Look at the various blocks and notice the area the blocks cover.

A small cube covers an area of 1 cm^2 (read as one square centimetre). A rod covers an area of 10 cm^2. A flat covers an area of 100 cm^2 or 1 dm^2 (read as one square decimetre).

1. Use base ten blocks to estimate the area that the irregular shape covers on page 92 of the Practice and Homework Book. (**Note:** Each of the squares in the grid paper is 1 cm by 1 cm and covers an area of $1\ cm^2$.)

2. Complete page 92 of the Practice and Homework Book. You may use any of the three methods discussed on page 208 of the textbook.

Check your answers on page 57 in the Appendix.

Sharing Time

Now it's time to discuss with your home instructor what you have been learning.

Turn to page 93 of the Practice and Homework Book and complete the page.

Your home instructor will help you check your answers.

Activity 3

Today you will draw an irregular figure that you estimate has a certain area or perimeter.

1. On plain paper, draw and label figures with the following characteristics:

   - **Figure A:** It has three sides, each side a different length, and an area of about 10 cm^2.
   - **Figure B:** It has six sides, all the same length, and an area of 25 cm^2.
   - **Figure C:** It has no straight sides and an area of about 30 cm^2.

   Cut out each figure, place it on a sheet of 1-cm grid paper and trace its outline. Then use any of the methods from Activity 1 to find the area of each figure you drew.

Check your answers on pages 58 and 59 in the Appendix.

2. On plain paper, draw and label figures with the following characteristics:

   - **Figure A:** It has four sides, each side the same length, and a perimeter of 20 cm.
   - **Figure B:** It has five sides, not all the same length, and a perimeter of 35 cm.
   - **Figure C:** It has no straight sides and a perimeter of 15 cm.

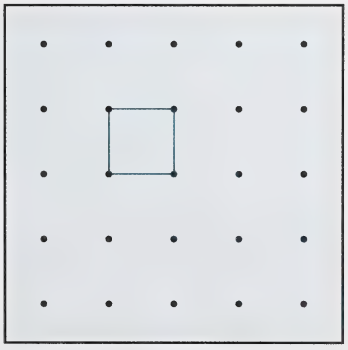
   Use a ruler to find the perimeter of each figure.

Check your answers on pages 59 and 60 in the Appendix.

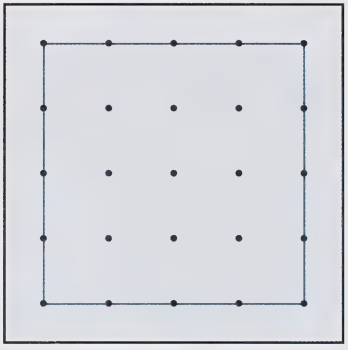
Challenge Activity

For this activity you will need a geoboard or dot paper. Dot paper is provided in the Appendix.

The smallest square that can be made on a 5-by-5 geoboard has an area of 1 square unit.



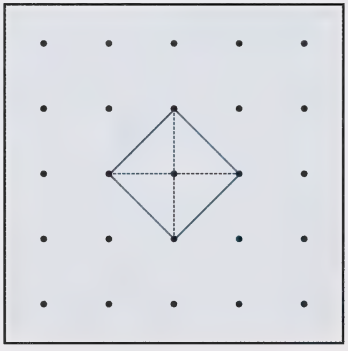
The largest square that can be made on a 5-by-5 geoboard has an area of 16 square units.



1. Use a 5-by-5 geoboard or the dot paper in the Appendix to make two more squares, each a different size. Use only horizontal and vertical lines. Then find the area of each square.

Check your answers on page 61 in the Appendix.

To find the area of the square shown below, divide it into four triangles. The area of each triangle is 0.5 square unit, so the area of the entire square is 2 square units.



2. Make three more squares, each a different size. You may use diagonal lines. Then find the area of each square.

Check your answers on page 61 in the Appendix.

Conclusion

In this lesson you estimated the perimeter and area of irregular figures.

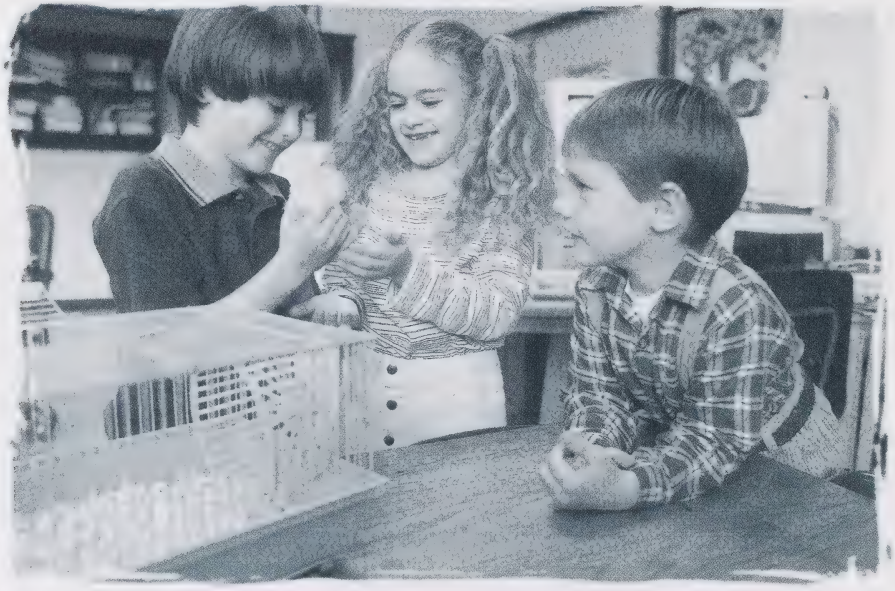
What area do you think this iceberg on Ellesmere Island in Nunavut covers? What do you estimate the perimeter of the iceberg is?

Turn to Assignment Booklet 7A and complete the Lesson 2 Assignment.

When you are done, send Assignment Booklet 7A to your distance learning teacher to be marked.

Lesson 3

Relating Perimeter and Area



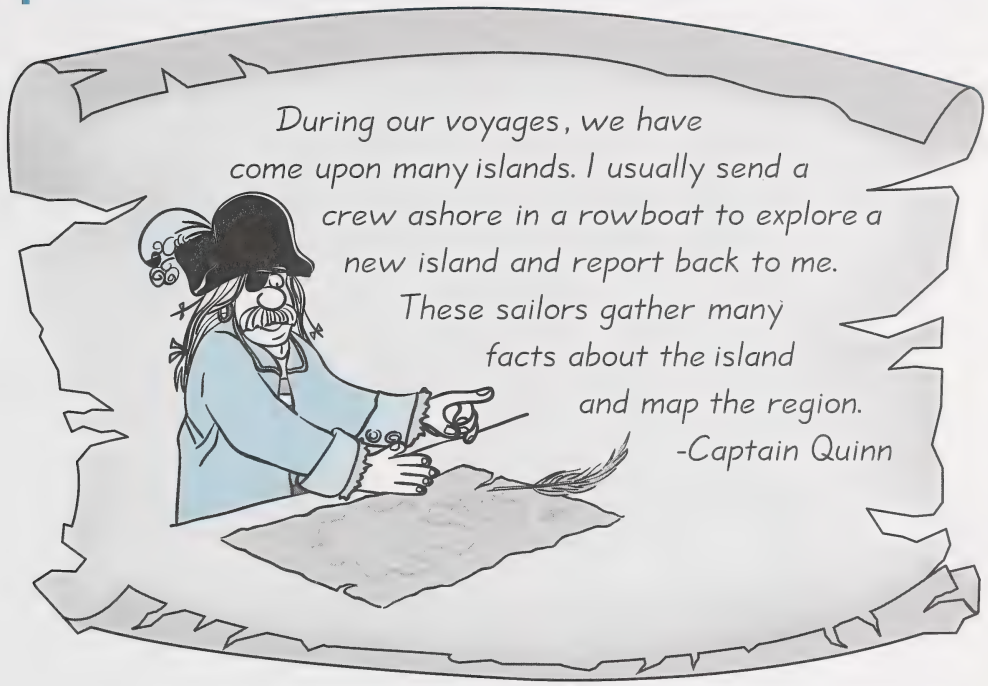
Do you have a pet hamster or a gerbil? Many children enjoy these small, furry, cute animals, and they are generally easy to care for.

One important consideration for keeping a hamster or a gerbil is the cage. You should have one that's at least 30 cm by 60 cm. With anything smaller, the animal won't have enough room.

Will all cages with the same perimeter have the same floor area? In other words, are perimeter and floor area related? In Lesson 3 you will investigate this question.

Activity 1

Today you will explore the relationships between perimeter and area.


During our voyages, we have
come upon many islands. I usually send a
crew ashore in a rowboat to explore a
new island and report back to me.
These sailors gather many
facts about the island
and map the region.
-Captain Quinn

The old maps made by sailors like Captain Quinn look very different from today's maps. The old maps often had elaborate drawings of ships and mythical sea creatures in the oceans.

Turn to pages 210 and 211 of your textbook. Use the map of the Strait of Georgia to answer the following questions.

1. Find the approximate perimeter in centimetres of each island (Denman Island, Hornby Island, Lasqueti Island, and Texada Island) in the scale drawing. To do this, lay string around the coastline of each island and then measure the length of the string.

2. Find the approximate area in square centimetres of each of the four islands in the scale drawing.

3. Cut a piece of string that is the same length as the coastline of Texada Island in the scale drawing. Experiment with the string and 1-cm grid paper.

   a. Create an island that has approximately the same perimeter as the scale drawing of Texada Island but about twice the area.

   b. Create an island that has approximately the same perimeter as the scale drawing of Texada Island but about half the area.

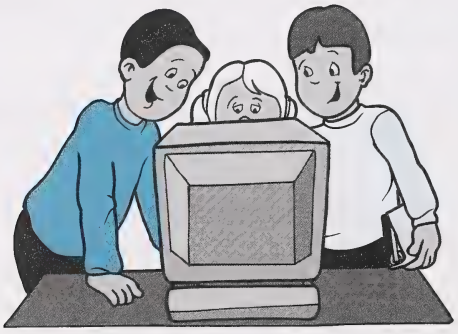
4. If you know the perimeter of a figure, can you predict its area? Explain.

Check your answers on page 62 in the Appendix.

If you are interested in learning more about the Northern Gulf Islands, you will find the following website helpful:

http://britishcolumbia.com

Enter the name of the island in the search engine on this site.



Activity 2

Today you will continue to explore the relationship between perimeter and area.

Turn to pages 206 and 207 in your textbook. Look at the tile designs in Exploring Perimeter and Area. Then use the square tiles from a set of pattern blocks to make designs A, B, and C.

1. For one of the designs (A, B, and C), do the following. For 1.c. to 1.f., draw pictures to show your work with the tiles.

   a. Find the area.

   b. Find the perimeter.

   c. Make a new design that has the same area but a shorter perimeter.

   d. Make a new design that has the same perimeter but a greater area.

   e. Make a new design that has the same area and the same perimeter but a different shape.

   f. Remove a tile so that the perimeter is **greater** than it was.

2. **a.** Make a design with an area of 6 square units and a perimeter of 14 units.

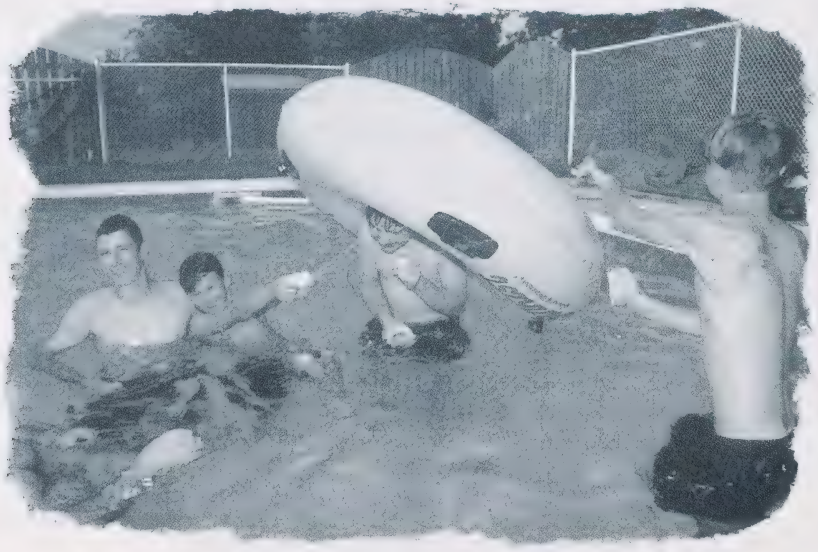
   b. Make a design with an area of 6 square units and a perimeter of 12 units.

   c. Make a design with an area of 6 square units and a perimeter of 10 units.

Check your answers on pages 63 to 66 in the Appendix.

Activity 3

Today you will continue to investigate the relationship between perimeter and area.



Owners of outdoor swimming pools must enclose their pools with a fence. This law is in place to protect small children who may accidentally fall into the pool. What are some other reasons for building fences?

1. Complete page 94 of the Practice and Homework Book.

2. Complete page 96 of the Practice and Homework Book.

Check your answers on pages 67 and 68 in the Appendix.

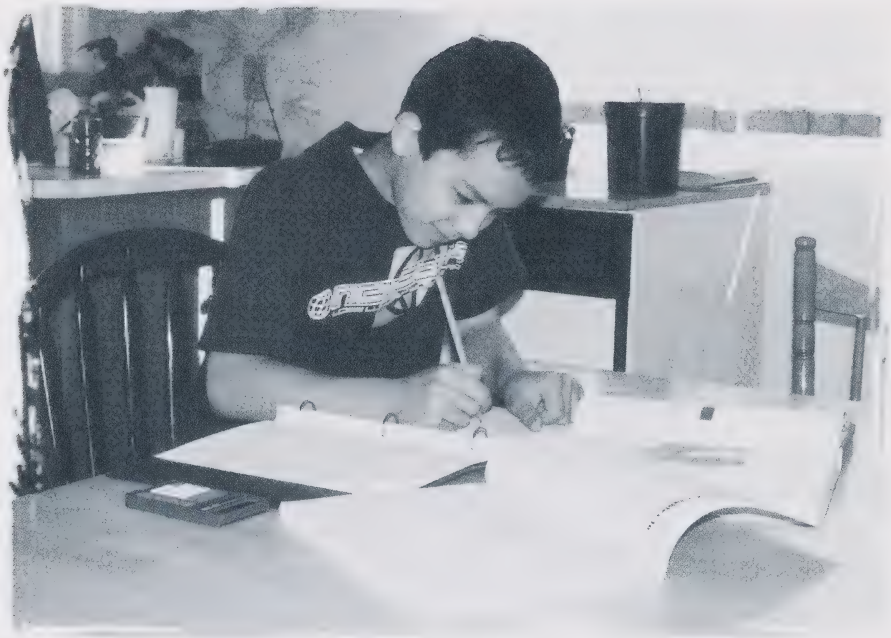
Sharing Time

Now it's time to discuss with your home instructor what you have been learning.

Complete pages 95 and 97 of your Practice and Homework Book.

Your home instructor will help you check your answers.

Challenge Activity



Are you ready to solve some problems?

1. Turn to page 220 of your textbook and answer questions 3 and 4 of Problem Bank. (**Hint:** Use 1-cm grid paper to help you see how to cut up the carpet.)

2. Turn to page 221 of your textbook and answer question 7 of Problem Bank.

Check your answers on pages 69 to 74 in the Appendix.

Conclusion

In this lesson you explored the relationship between area and perimeter. You discovered that there are many shapes with the same area but different perimeters. You also found that there are many shapes with the same perimeter but different areas.

If you wanted to make a rectangular pen for chickens that enclosed the greatest area with the least amount of fencing, what shape would you make the pen?

Turn to Assignment Booklet 7B and complete the Lesson 3 Assignment.

Keep Assignment Booklet 7B until you have completed the entire booklet.

Module Summary

The three lessons in Module 7 helped you extend your understanding of measurement and problem solving. You used metric units to measure the length, width, height, depth, thickness, perimeter, and circumference of objects. You learned techniques for estimating the perimeters and areas of irregular figures. You explored the relationship between perimeter and area.

These skills and knowledge helped you solve problems like the following: If a rectangular garden is 3 m by 2 m, will 16 m of fencing enclose the entire garden? If a bag of fertilizer covers 5 m^2, will one bag cover the entire garden?

Turn to Assignment Booklet 7B and complete the Numbers in the News project.

When you are done, send Assignment Booklet 7B to your distance learning teacher to be marked.

Keystrokes

Take out your calculator and complete the following exercises. They will help you review some of the ideas you learned in Module 7.

Funky Feature: Shortcut Square

An easy way to multiply a number by itself on the calculator is to enter the number, press the × key, and then press the = key. For example, to multiply 5×5, you would do the following:

Keystrokes	ON/C	5	×	=
Display	0	5	5	25

You can also use this shortcut square method to practise your estimation skills. If a square array encloses 1369 grid squares, what are the dimensions of the square in grid units? Guess and check to find out!

Keystrokes	ON/C	23	×	=	33	×	=	37	×	=
Display	0	23	23	529	33	33	1089	37	37	1369

Try again. Try again. Correct. The dimensions are 37 units by 37 units.

1. Find the dimensions of the arrays that enclose the following numbers of grid squares. Try to find the answers by making as few guesses as possible.

   a. 841 **b.** 961 **c.** 1444 **d.** 3136 **e.** 4225

Funky Feature: Remainders

Calculators can be very helpful when you need to divide numbers that are not easy to work with mentally. That's the good news. The bad news is that you cannot always use the displayed answer directly to solve a problem.

Example

Bill wants to divide a large 135-m^2 vegetable garden into smaller sections that each measure 6 m^2. He will use any remaining area to plant flowers. How many 6-m^2 sections can Bill make? What area will be left to plant flowers in?

Keystrokes	ON/C	135	÷	6	=
Display	0	135	135	6	22.5

The answer displayed on your calculator can be used to answer your first question. Bill can divide the large vegetable garden into 22 sections that each measure 6 m^2.

The second question asks you how many square metres Bill will have left over. The decimal portion of the display, however, does not tell you the remainder. Actually, the 0.5 tells you what fraction of a 6-m^2 section will be left over. In other words, it tells you that half of 6 m^2 is left over. You can easily find the answer $(3\ m^2)$ mentally.

Because it isn't always easy to do the calculations mentally, you can use another strategy to find the number of square metres left over. First, find the total area that will be used by the 22 sections by multiplying 22 by 6. Then subtract that product from 135.

Keystrokes	ON/C	22	×	6	=
Display	0	22	22	6	132

The 22 sections will use 132 m^2, so Bill will have $135\ m^2 - 132\ m^2 = 3\ m^2$ left over to plant flowers.

2. Use this method to find the remainders for each of the following problems.

a. At the bottle depot, Jim put 443 empty cans into cartons. Each carton held 12 cans. How many cartons did Jim fill? How many cans were left over?

b. Kati had 219 stickers. She put 15 stickers on each page of her sticker book and kept the rest for trading. How many pages did Kati fill? How many stickers were left over for trading?

c. A tour bus can hold 65 passengers. If 436 people signed up for a tour, how many buses would be filled? How many passengers would be left over for another bus?

Check your answers on pages 74 and 75 in the Appendix.

Review

This review will help you apply what you learned in Module 7 and prepare for the final test. Discuss with your home instructor when you should begin the Review and how much of the Review you should complete.

1. Write the symbol for the unit you would use for each measure.

a. the length of a baseball bat
b. the thickness of a nickel
c. the distance between two cities

2. What tools would you use to measure these distances?

a. the length of a soccer field
b. the width of a postage stamp
c. the circumference of a baseball

If you need help with questions 1 and 2, look back at Lesson 1, where you learned about measuring length. If you feel you need more practice, do question 3.

3. Tell what unit and what measuring tool you would use to measure the following distances.

a. the width of a kitchen cupboard
b. the distance you could bicycle in an hour
c. the circumference of a drinking straw

Check your answers on page 75 in the Appendix.

4. Turn to page 211 of your textbook. Do questions 1 and 2 of Practise Your Skills.

If you need help with question 4, look back at Lesson 2, where you learned techniques for finding perimeters and areas of irregular shapes. If you feel you need more practice, do question 5.

5. Do Skill Bank from This Unit questions 4 and 5 on page 222 of your textbook.

Check your answers on page 76 in the Appendix.

6. Turn to page 213 of your textbook and answer questions 1 and 2 of On Your Own.

7. Turn to page 215 of your textbook and answer questions 3 and 4 of On Your Own.

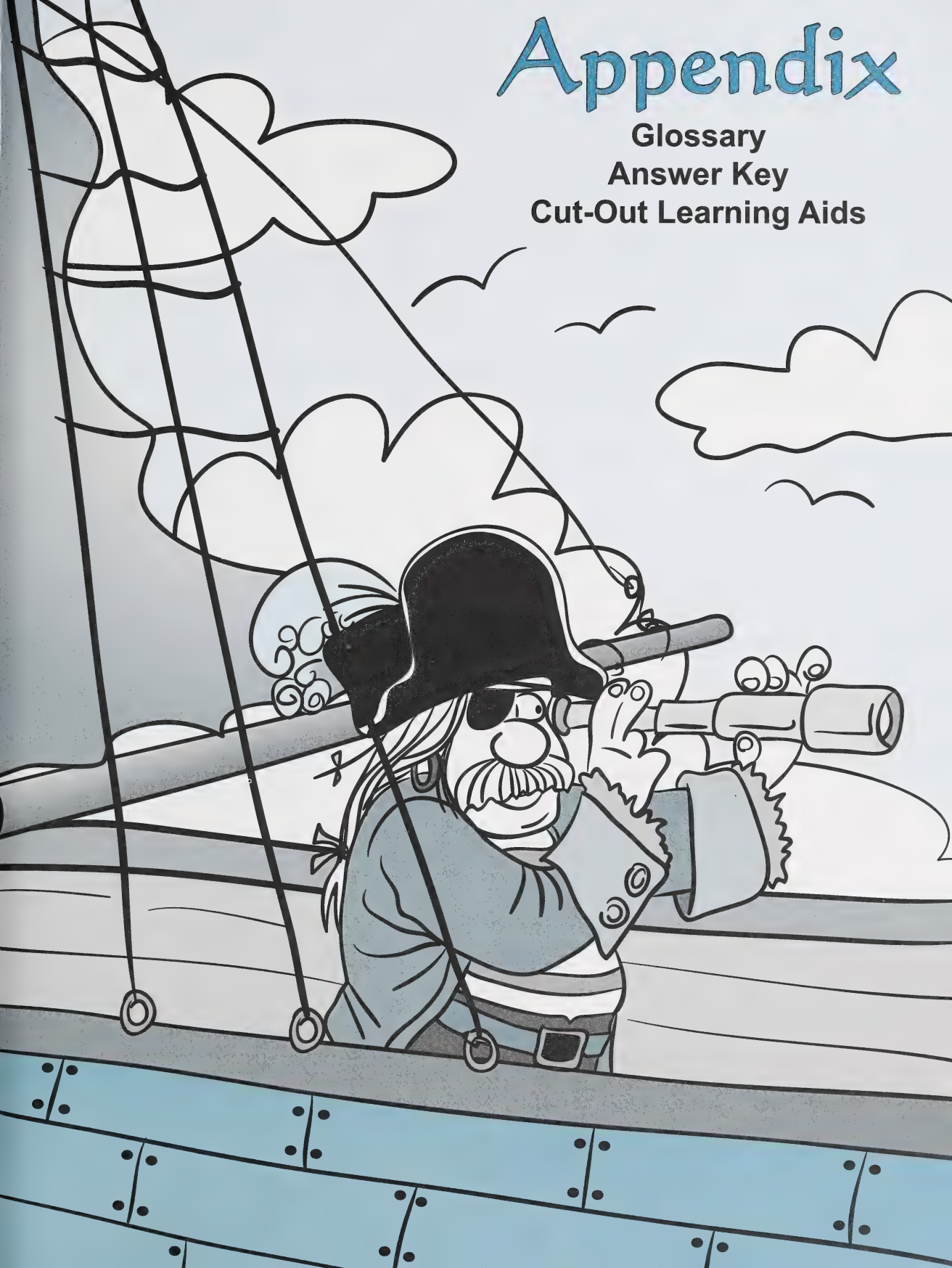
If you need help with questions 6 and 7, look back at Lesson 3, where you learned about how perimeter and area are related. If feel you need more practice, do question 8, 9, and 10.

8. Turn to page 222 in your textbook. Do Skill Bank from This Unit question 3. Try to find three answers for question 3.a. and three answers for question 3.b.

9. Turn to page 213 of your textbook. Do questions 1 and 2 of Practise Your Skills.

10. Turn to page 215 of your textbook. Do questions 1 and 2 of Practise Your Skills.

Check your answers on pages 76 to 80 in the Appendix.



Appendix

Glossary
Answer Key
Cut-Out Learning Aids

Glossary

area: the number of square units a figure covers

circumference: distance around a circle

linear measurements: measures of distance

linear units: units for measuring distances, such as length, width, height, thickness, perimeter, and circumference

perimeter: distance around a polygon

Answer Key

Lesson 1: Using Linear Units

Activity 1

1. **a.** The Catrina had the longest deck.
   b. The Rosa had the shortest deck.
   c. The Estelle had the widest deck.
   d. The Genevieve had the second narrowest deck.

2. **a.** The Bologne had the third deepest hold.
   b. The Genevieve had the shallowest hold.

3. **a.** The Estelle had the highest mainmast.
   b. The Florida had the second shortest mainmast.

4. Captain Swain might have been the captain of the Rosa, the Florida, the Contessa, or the Bologne.

5. No, Captain Quinn would probably not have agreed. It is true that the Catrina was longer than the Estelle, but the Estelle had a wider deck, a deeper hold, and a higher mainmast.

6. Perimeter and circumference both mean the total distance around an object. The term *perimeter* is used for the distance around a polygon (a figure with straight sides). The term *circumference* is used for the distance around a circle.

Activity 2

1. The length of the textbook is 28.3 cm.
   The width of the textbook is 21.5 cm.
   The thickness of the textbook is 2.0 cm.

2. **Practice and Homework Book, page 88**

   The size of some of the objects may vary.

What to Measure	Measuring Tool	Estimate	Actual Measurement
perimeter of the cover of this book	string, ruler	100 cm	97.6 cm
thickness of a dictionary	ruler	4 cm	3.8 cm
circumference of a ball or globe	cloth tape measure	45 cm	38 cm
mass of a chalkboard brush	—	—	—
area of the sole of your shoe	—	—	—
width of your thumb	ruler	2 cm	1.7 cm
height of the classroom door	metal tape measure	2 m	213 cm or 2.13 m
capacity of a paper cup	—	—	—

Activity 3

1. Answers will vary. Sample answers are given.

Container or Object	Circumference (cm)	Height (cm)
Soup Can (284 mL)	21	10
Tuna Can (170 g)	26.5	4
Glue Stick (25 g)	8.5	10
Tomato Paste Can	16.5	8.5
Ravioli Can	23	11
Vegetable Oil Spray	21	21
Highlighter	3.5	13
Film Container	10	5
Paper Towel Roll	14	28
Tennis Ball Can (3 balls)	23	20.5

2. **a.** The soup can, the tomato paste can, the film container, and the ravioli can all have heights that are about half their circumference.

   b. The vegetable oil spray, the tennis ball can, and the glue stick all have heights that are about the same as the circumference.

   c. The height of the paper towel roll is about twice its circumference.

Challenge Activity

1. **Textbook, page 216, questions 1 and 3**

   1. The knotted ropes used by the Egyptians can be compared to today's tape measures. The tape measure is more accurate and more precise.

   3. You could use a knotted rope today to measure the rows in your garden. (Accuracy and precision are not important.) The rope could be several metres in length. The knots could be made every decimetre (10 cm).

2. **a.** To measure 2 dm, use the distance between the 1-dm and 3-dm knots.
   b. To measure 4 dm, use the distance between the 3-dm and 7-dm knots.
   c. To measure 5 dm, use the distance between the 7-dm and 12-dm knots.
   d. To measure 6 dm, use the distance between the 1-dm and 7-dm knots.
   e. To measure 8 dm, use the distance between the 12-dm knot and 20-dm end.
   f. To measure 9 dm, use the distance between the 3-dm and 12-dm knots.
   g. To measure 11 dm, use the distance between the 1-dm and 12-dm knots.
   h. To measure 13 dm, use the distance between the 7-dm knot and the 20-dm end.
   i. To measure 17 dm, use the distance between the 3-dm knot and the 20-dm end.
   j. To measure 19 dm, use the distance between the 1-dm knot and the 20-dm end.

3. The following decimetre distances cannot be measured with Kassidy's string ruler: 10 dm, 14 dm, 15 dm, 16 dm, and 18 dm.

4. Kassidy can tie knots at 2 dm and 16 dm.

Lesson 2: Finding the Perimeter and Area of an Irregular Shape

Activity 1

1. **Method 1**

   Squares completely inside the figure + Squares with more than one half inside

   $= 26 + 17$

   $= 43$ squares

   Method 2

   Squares inside the rectangles + Half the partial squares outside the rectangles but inside the figure

   $= 24 + (32 \div 2)$

   $= 24 + 16$

   $= 40$ squares

Method 3

Squares inside the rectangle – Squares with more than half outside

$= 60 - 18$

$= 42$ squares

2. a. The approximate areas found by using the different methods are almost the same. This means that each of the procedures is an appropriate method for finding the approximate area of the footprint.

b. Answers will vary. A sample answer is given.

I like the third method the best because it was easier for me to decide which squares to count.

3. Answers will vary. Sample answers are given.

Method 1: Length of string $= 28$ squares long

Method 2: Double the length of string $= 14$ squares long $\times 2 = 28$ squares long

Method 3: Sum of segments $= 23$ squares long

4. a. Methods 1 and 2 gave the same approximate perimeters. Method 3 gave a similar but smaller perimeter.

b. Answers will vary. A sample answer is given.

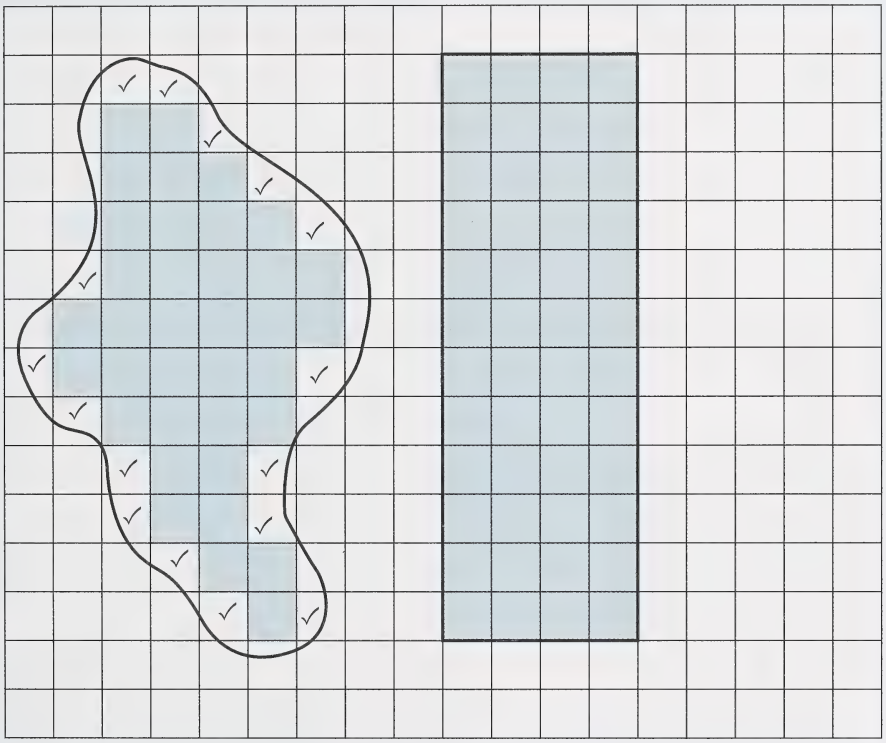
I found Method 2 the easiest to use because when I measured the length of the string that went around half the figure, it did not stretch past the size of the diagram.

Activity 2

1. The area covered by the irregular figure is about half the area covered by a flat. In other words, the area covered by the deflated balloon is about $100 \div 2 = 50$ cm^2.

2. **Practice and Homework Book, page 92**

   Answers for the rectangle and questions 2 and 3 will vary. A sample answer is given.



1. Area: 52 cm^2
   Perimeter: 32 cm

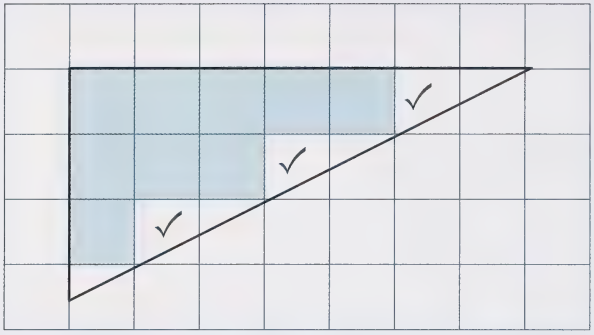
2. Area: 48 cm^2
   Perimeter: 32 cm

3. I used a string to trace the edges of the irregular figure. I then measured the length of the string I used to determine the perimeter. I shaded the whole squares and counted them to find the area, and then I added each square that has more than one half within the figure.

Activity 3

1. Answers will vary. Sample answers are given.

Figure A: It must have three sides, each a different length, and an area of about $10\ cm^2$.

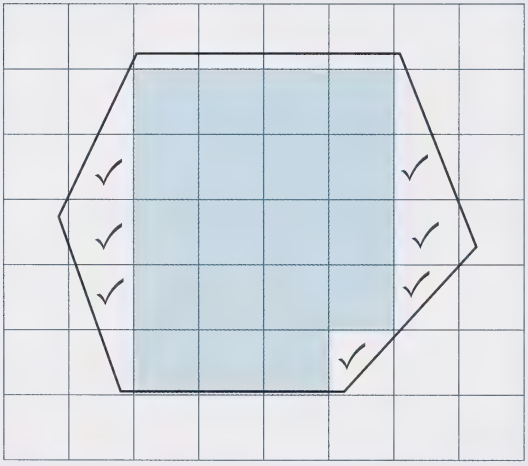


Squares completely within the figure: 9

Squares more than half within the figure: 3

$$\text{Area} = 9 + 3 = 12\ cm^2$$

Figure B: It must have six sides, all the same length, and an area of $25\ cm^2$.

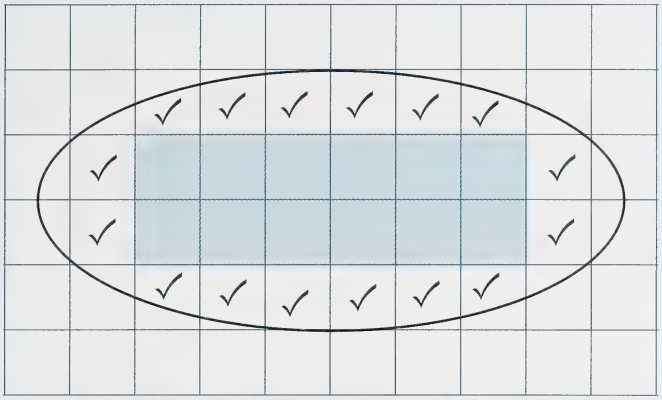


Total squares in the two rectangles: $16 + 3 = 19$

Squares more than half within the figure: 7

$$\text{Area} = 19 + 7 = 26\ cm^2$$

Figure C: It must have no straight sides and an area of 30 cm^2.



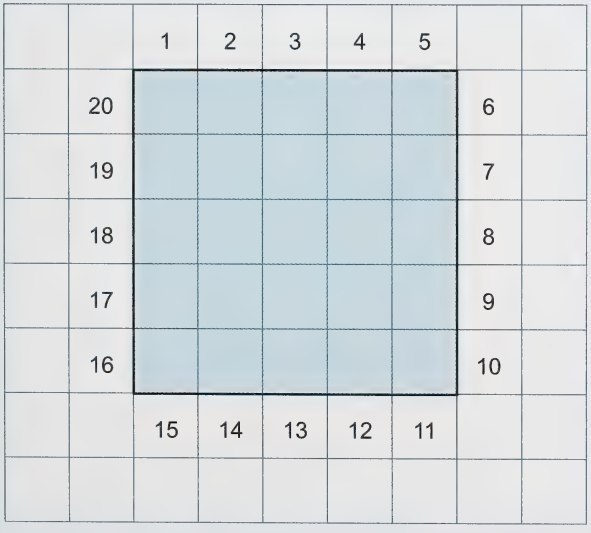
Squares in rectangle: 12

Squares more than half within the figure: 16

$$\text{Area} = 12 + 16 = 28 \text{ cm}^2$$

2. Answers will vary. Sample answers are given.

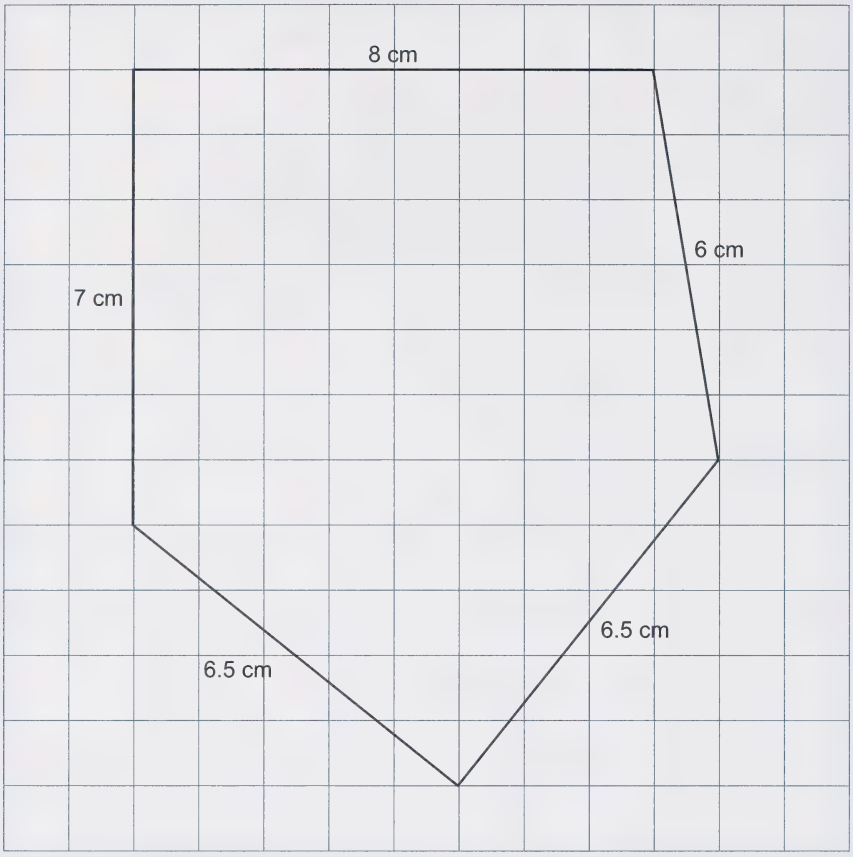
Figure A: It must have four sides, each side the same length, and a perimeter of 20 cm.



Count total segments around the figure.

Perimeter = 20 cm

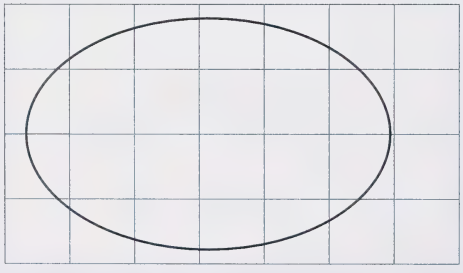
Figure B: It must have five sides, not all the same length, and a perimeter of 35 cm.



Use a ruler to measure the sides and then find the sum.

Perimeter $= 8 + 6 + 6.5 + 6.5 + 7 = 34$ cm

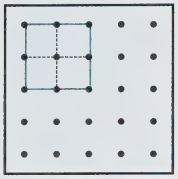
Figure C: It has no straight sides and a perimeter of 15 cm.



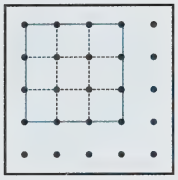
Lay a string around the edge of the figure, and then measure the string.

Perimeter $= 18$ cm

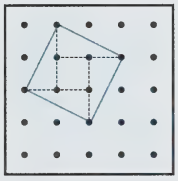
Challenge Activity

1. 

Area = 4 square units

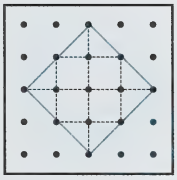


Area = 9 square units

2. 

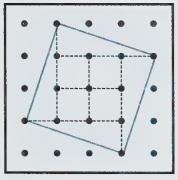
Area = 5 square units

Divide the square into one smaller square with an area of 1 square unit, and four triangles, each with an area of 1 square unit. **Note:** Each triangle is half of a rectangle with an area of 2 square units $(2 \div 2 = 1)$.



Area = 8 square units

Divide the square into four smaller squares, each with an area of 1 square unit, and eight triangles, each with an area of 0.5 square units.



Area = 10 squares

Divide the square into four smaller squares, each with an area of 1 square unit, and four triangles, each with an area of 1.5 square units. **Note:** Each triangle is half of a rectangle with an area of 3 square units $(3 \div 2 = 1.5)$.

Lesson 3: Relating Perimeter and Area

Activity 1

1. Denman Island: 9 cm
   Hornby Island: 7 cm
   Lasqueti Island: 9 cm
   Texada Island: 23 cm

2. Denman Island: 2.5 cm^2
   Hornby Island: 1.5 cm^2
   Lasqueti Island: 3 cm^2
   Texada Island: 12 cm^2

3. Answers will vary. Sample answers are given.

   a. Perimeter = 115 km
      Area is about 600 km^2

   b. Perimeter = 115 km
      Area is about 140 km^2

4. No, if you know the perimeter of a figure, you cannot predict its area. Figures with the same perimeter can have different shapes and different areas. For example, the two islands in question 3 had the same perimeter. One island was longer and thinner than the other island, and its area was much less than the area of the other island.

Activity 2

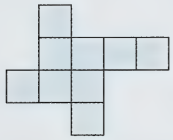
1. Design A

a. Area = 9 square units

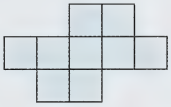
b. Perimeter = 20 units

c. Answers will vary. Sample answers are given.

Same area (9 square units) but perimeter less than 20 units:



Perimeter = 18 units



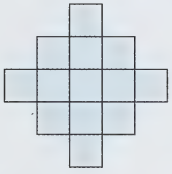
Perimeter = 16 units

Perimeter = 12 units

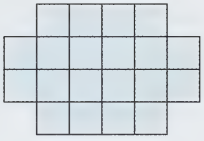
d. Answers will vary. Sample answers are given.

Same perimeter (20 units) but area greater than 9 square units:

Area = 11 square units



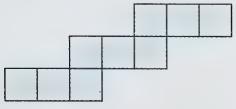
Area = 13 square units

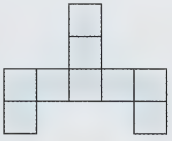


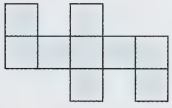
Area = 20 square units

e. Answers will vary. Sample answers are given.

Same area (9 square units) and same perimeter (20 units) but a different shape:







f. It is impossible to remove a tile from design A and increase its perimeter.

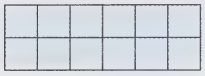
Design B

a. Area = 12 square units

b. Perimeter = 18 units

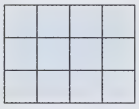
c. Answers will vary. Sample answers are given.

Same area (12 square units) but perimeter less than 18 units:



Perimeter = 16 units

Perimeter = 16 units

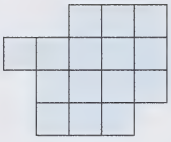


Perimeter = 14 units

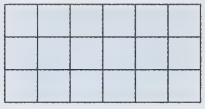
d. Answers will vary. Sample answers are given.

Same perimeter (18 units) but area greater than 12 square units:

Area = 14 square units



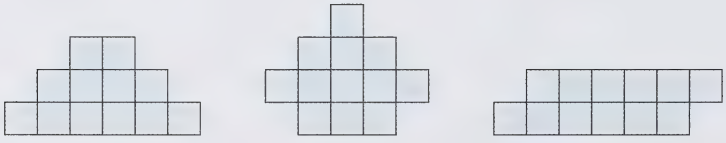
Area = 15 square units



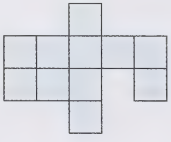
Area = 18 square units

e. Answers will vary. Sample answers are given.

Same area (12 square units) and same perimeter (18 units) but a different shape:



f. Remove a tile so the perimeter is greater than 18 units:



Perimeter = 20 units

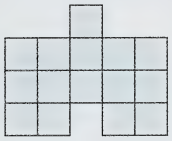
Design C

a. Area = 15 square units

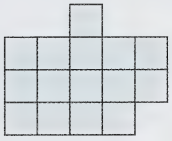
b. Perimeter = 24 units

c. Answers will vary. Sample answers are given.

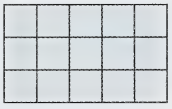
Same area (15 square units) but perimeter less than 24 units:



Perimeter = 20 units



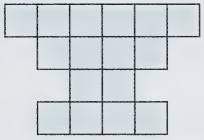
Perimeter = 18 units



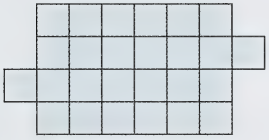
Perimeter = 16 units

d. Answers will vary. Sample answers are given.

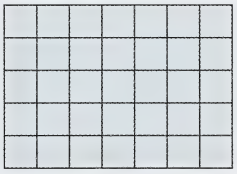
Same perimeter (24 units) but area greater than 15 square units:



Area = 16 square units



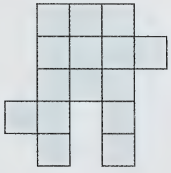
Area = 26 square units

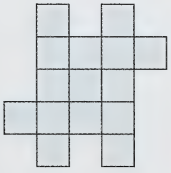


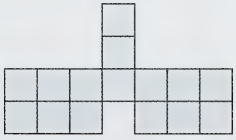
Area = 35 square units

e. Answers will vary. Sample answers are given.

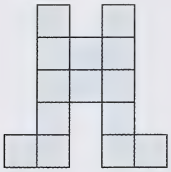
Same area (15 square units) and same perimeter (24 units) but a different shape:



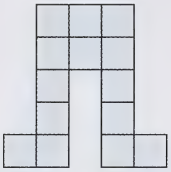




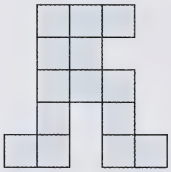
f. Remove a tile so the perimeter is greater than 24 units.



Perimeter = 26 units



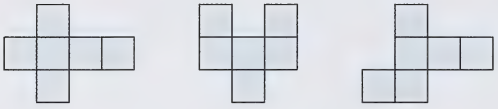
Perimeter = 26 units



Perimeter = 26 units

2. a. Answers will vary. Sample answers are given.

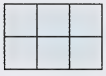
A design that has an area of 6 square units and a perimeter of 14 units:



b. Answers will vary. Sample answers are given.

A design that has an area of 6 square units and a perimeter of 12 units:

c. A design that has an area of 6 square units and a perimeter of 10 units:

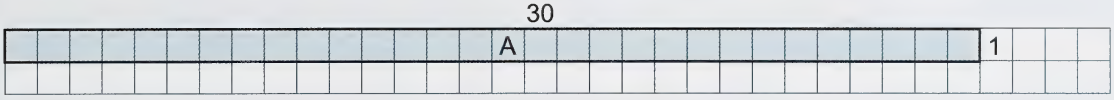


Activity 3

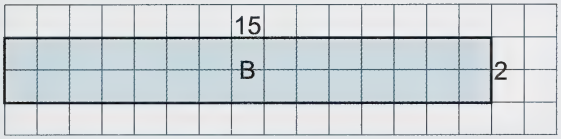
1. Practice and Homework Book, page 94

1. and 2.

Each square on the grids represents 1 m^2.

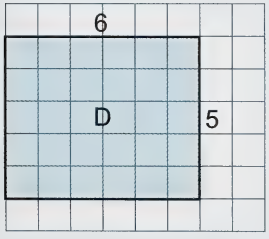


P = 62 m



P = 34 m

P = 26 m



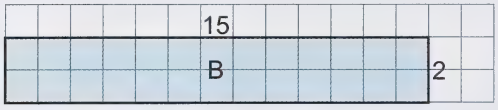
P = 22 m

3. Figure D would make the best rabbit pen because it requires less fencing.

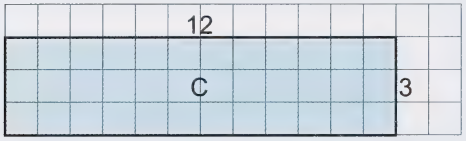
2. Practice and Homework Book, page 96

1. and 2.

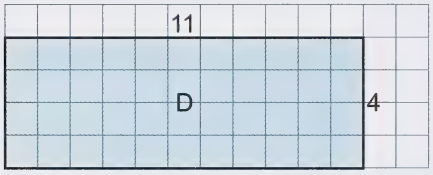
$A = 14\ m^2$



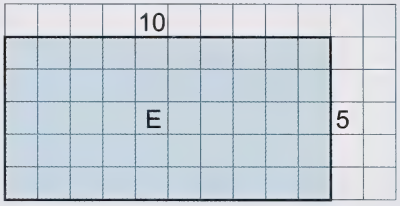
$A = 26\ m^2$



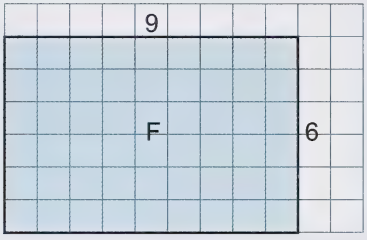
$A = 36\ m^2$



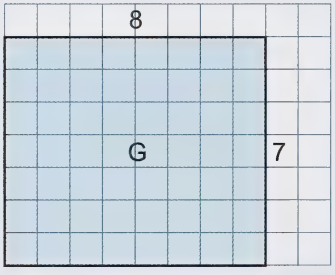
$A = 44\ m^2$



$A = 50\ m^2$



$A = 54\ m^2$



$A = 56\ m^2$

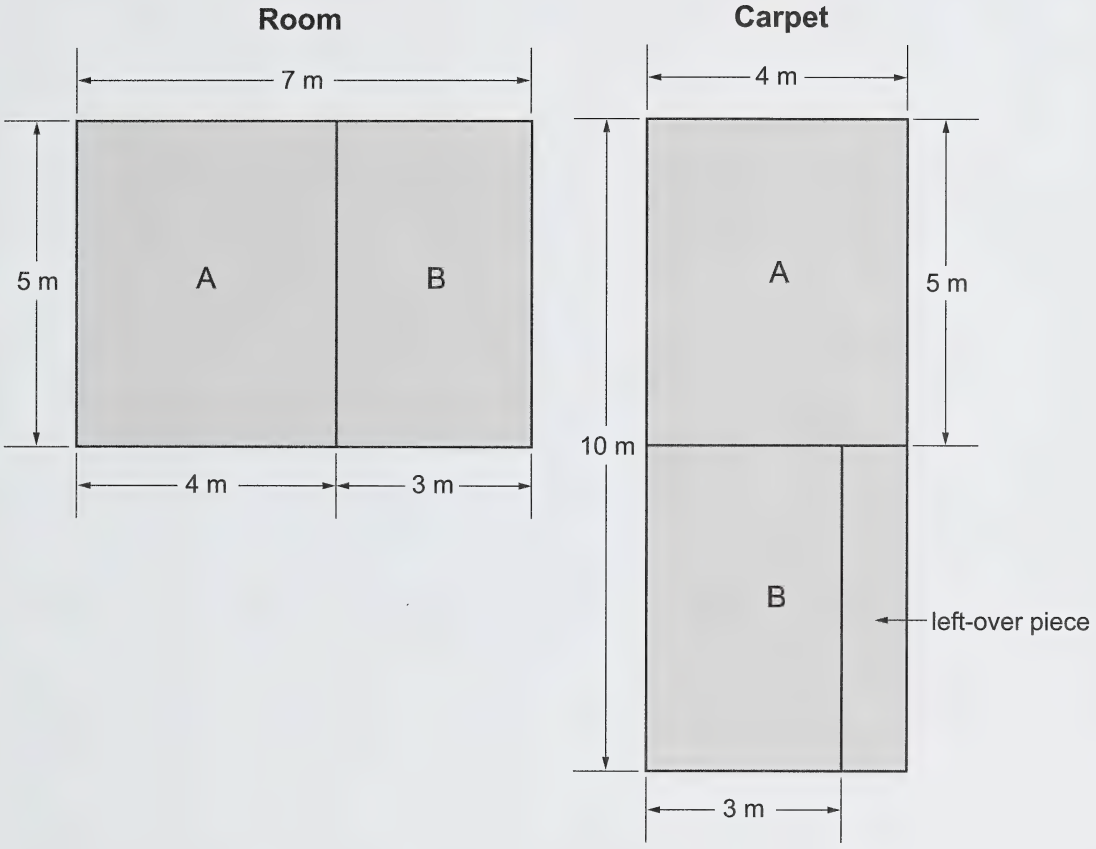
3. Design G is best because it encloses the most area with the same amount of fencing.

Challenge Activity

1. Textbook, page 220, Problem Bank, questions 3 and 4

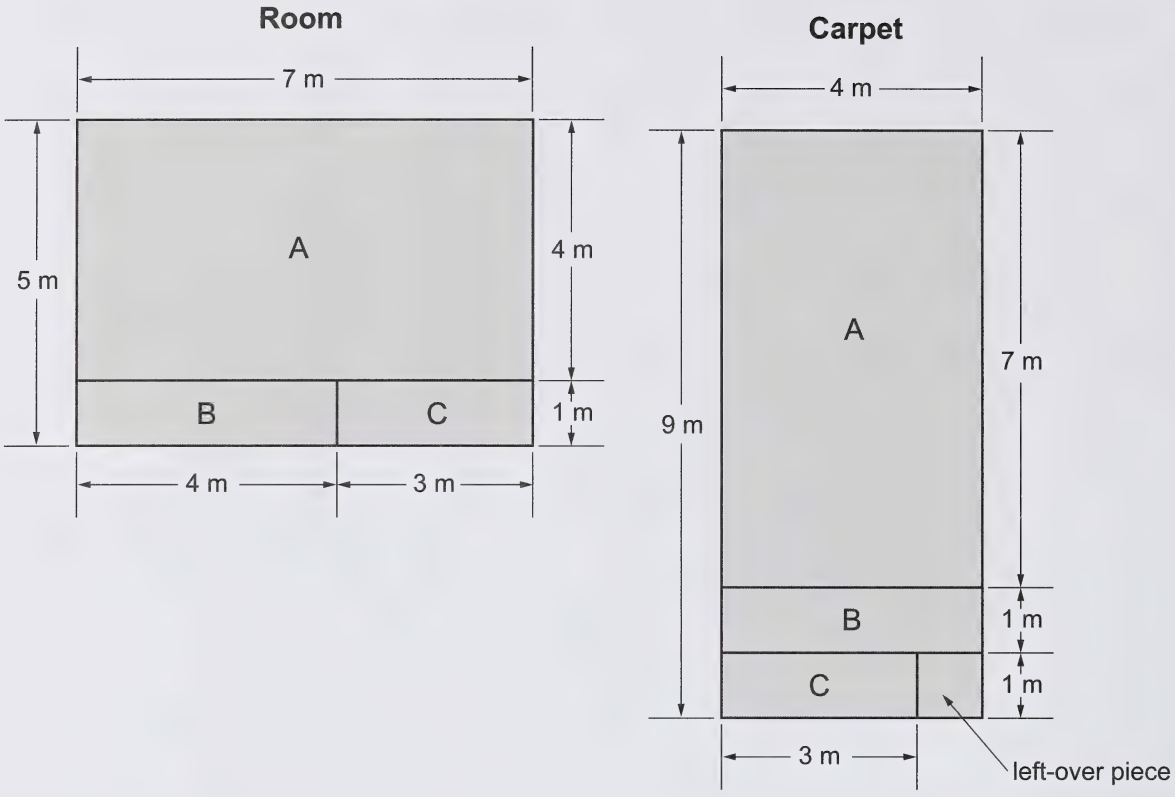
3. There are several possible solutions.

Solution 1



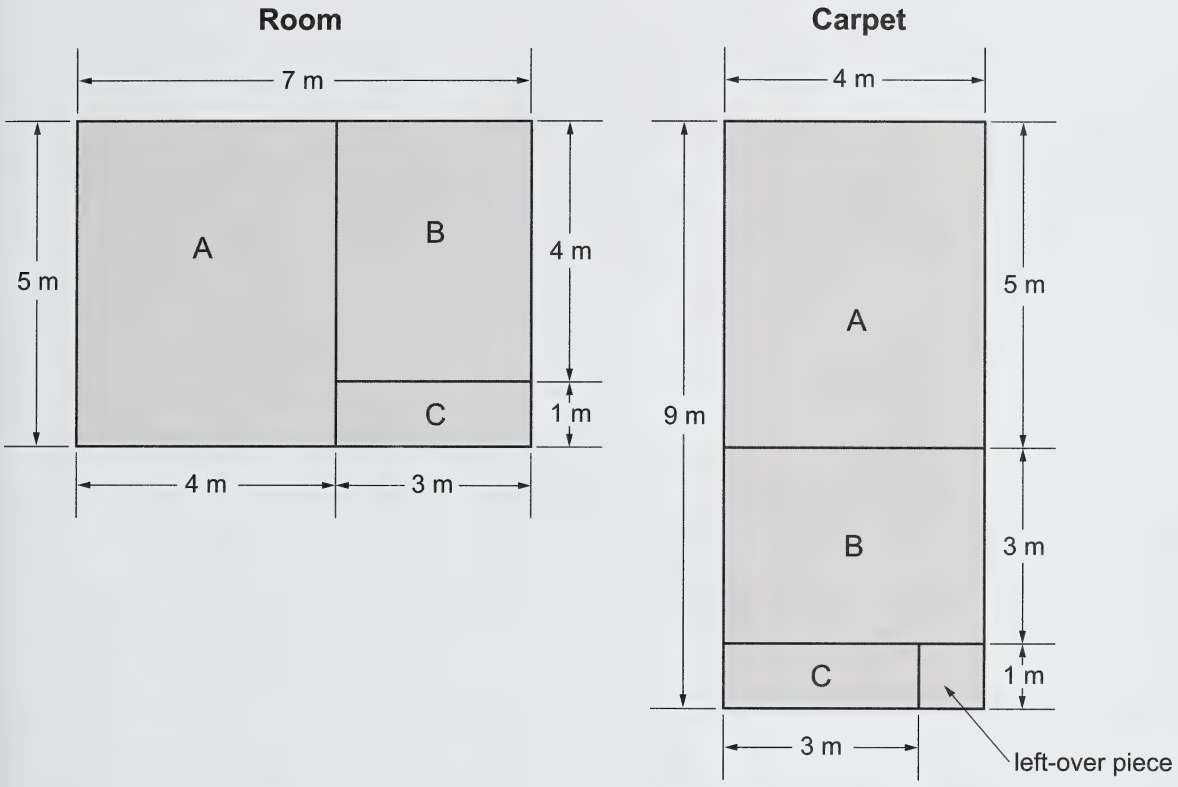
This method requires 10 m of carpet. A piece of carpet 1 m by 5 m will be left over.

Solution 2



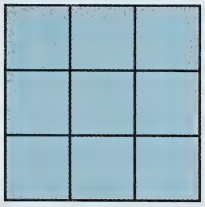
This method requires 9 m of carpet. A piece of carpet 1 m by 1 m will be left over.

Solution 3



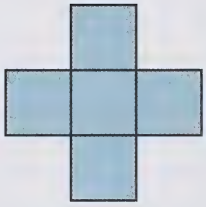
This method requires 9 m of carpet. A piece of carpet 1 m by 1 m is left over.

4.

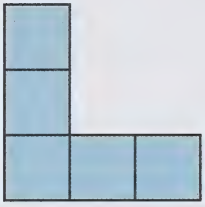


Perimeter: 12 units
Area: 9 square units

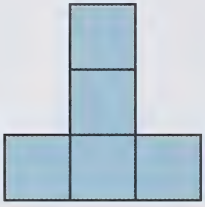
There are several solutions.



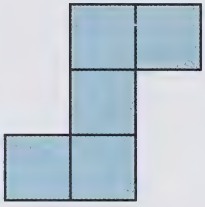
Perimeter: 12 units
Area: 5 square units



Perimeter: 12 units
Area: 5 square units



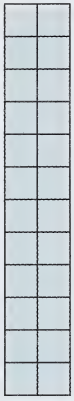
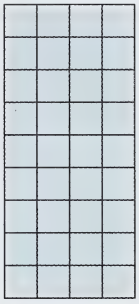
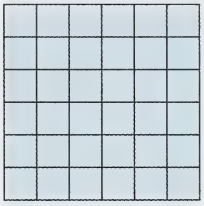
Perimeter: 12 units
Area: 5 square units



Perimeter: 12 units
Area: 5 square units

2. Textbook, page 221, Problem Bank, question 7

Rectangles with an area of 36 cm^2, arranged from least to greatest width:

Picture					
Dimensions	1 by 36	2 by 18	3 by 12	4 by 9	6 by 6
Perimeter	74 units	40 units	30 units	26 units	24 units

As the width increases, the length decreases, and the rectangle gets closer to being a square. As this happens, the perimeter also decreases.

Keystrokes

1. a.

Keystrokes	29	×	=
Display	29	29	841

b.

Keystrokes	31	×	=
Display	31	31	961

c.

Keystrokes	38	×	=
Display	38	38	1444

d.

Keystrokes	56	×	=
Display	56	56	3136

e.

Keystrokes	65	×	=
Display	65	65	4225

2. a.

Keystrokes	443	÷	12	=
Display	443	443	12	36.916666

Keystrokes	36	×	12	=
Display	36	36	12	432

Jim filled 36 cartons.

$443 - 432 = 11$, so there were 11 cans left over.

b.

Keystrokes	219	÷	12	=
Display	219	219	15	14.6

Keystrokes	14	×	15	=
Display	14	14	15	210

Kati filled 14 pages.

$219 - 210 = 9$, so she had 9 stickers for trading.

c.

Keystrokes	436	÷	65	=
Display	436	436	65	6.7076923

Keystrokes	6	×	65	=
Display	6	6	65	390

There would be 6 buses filled.

$436 - 390 = 46$, so 46 passengers would be left over for another bus.

Review

1. a. cm **b.** mm **c.** km

2. a. metal tape measure
b. millimetre ruler
c. cloth tape measure or string and a ruler

3. a. To measure the width of a kitchen cupboard, I would use a metre-stick or a tape measure with centimetre or millimetre markings, depending on the reason for making the measurement.

b. To measure the distance I could bicycle in an hour, I would use an odometer. Odometers usually measure to the nearest tenth of a kilometre.

c. To measure the circumference of a drinking straw, I would wrap a string around it, and then use a millimetre ruler to measure the length of the string.

4. Textbook, page 211, Practise Your Skills, questions 1 and 2

1. a. $3\text{ cm} + 3\text{ cm} + 2\text{ cm} + 2\text{ cm} = 10\text{ cm}$
b. $2\text{ cm} + 2\text{ cm} + 2\text{ cm} + 3\text{ cm} + 4\text{ cm} = 13\text{ cm}$

2. a. Between 11 and 12 square units
b. About 12 square units

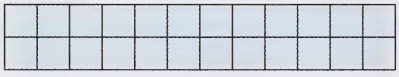
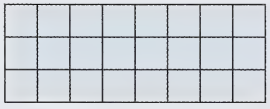
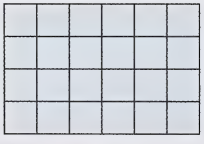
5. Textbook, page 222, Skill Bank from This Unit, questions 4 and 5

4. a. The area is about 8 square units. The perimeter is about 13 units.
b. The area is 9 or 10 square units. The perimeter is about 12 units.

5. a. The perimeter is $2\text{ cm} + 3\text{ cm} + 4\text{ cm} + 2\text{ cm} + 1\text{ cm} = 12\text{ cm}$.
b. The perimeter is $4\text{ cm} + 2\text{ cm} + 1\text{ cm} + 3\text{ cm} + 2\text{ cm} = 12\text{ cm}$.

6. Textbook, page 213, On Your Own, questions 1 and 2

1.

Rectangle	Dimensions	Perimeter
	1 cm by 24 cm	50 cm
	2 cm by 12 cm	28 cm
	3 cm by 8 cm	22 cm
	4 cm by 6 cm	20 cm

The 1 cm by 24 cm rectangle has the longest perimeter.
The 4 cm by 6 cm rectangle has the shortest perimeter.

2. If the dimensions of the garden are in whole metres, then a 5 m by 6 m garden would require the least fencing. Its perimeter of 22 m would be the shortest perimeter for a 30-m^2 garden.

   Other possible dimensions would be 1 m by 30 m, with a perimeter of 62 m; 2 m by 15 m, with a perimeter of 34 m; and 3 m by 10 m, with a perimeter of 26 m.

7. Textbook, page 215, On Your Own, questions 3 and 4

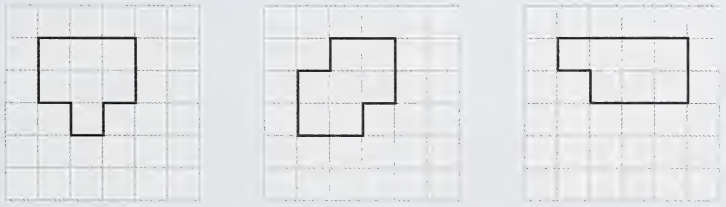
3. If the garden is rectangular with dimensions in whole metres, then Tobias' garden could be 1 m by 13 m, with an area of 13 m^2; 2 m by 12 m, with an area of 24 m^2; 3 m by 11 m, with an area of 33 m^2; 4 m by 10 m, with an area of 40 m^2; 5 m by 9 m, with an area of 45 m^2; 6 m by 8 m, with an area of 48 m^2; or 7 m by 7m, with an area of 49 m^2.

4. If the area is rectangular with dimensions in whole metres, then the smallest area you could enclose with the string would be 1 m by 17 m, with an area of 17 m^2; and the largest area would be a 9 m by 9 m square, with an area of 81 m^2.

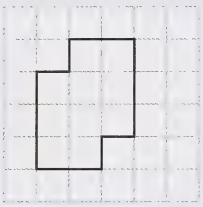
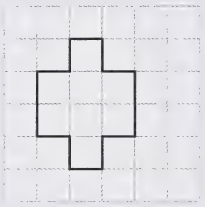
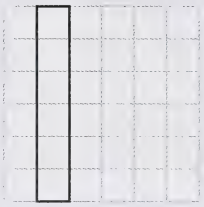
8. Textbook, page 222, Skill Bank from This Unit, question 3

3. Answers will vary. Sample answers are given.

   a. Area of 7 square units and perimeter not 14 units:



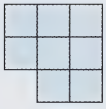
b. Perimeter of 14 units and area not 7 square units:

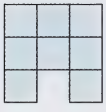
9. Textbook, page 213, Practise Your Skills, questions 1 and 2

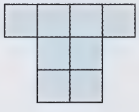
1. Answers will vary. Sample answers are given.

a. Perimeter = 12 units

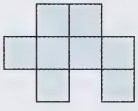
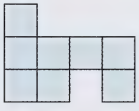


b. Perimeter = 14 units

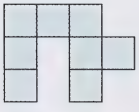
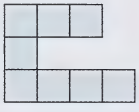
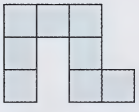




c. Perimeter = 16 units

d. Perimeter = 18 units

2. a. Top figure: area = 5 square units
perimeter = 12 units

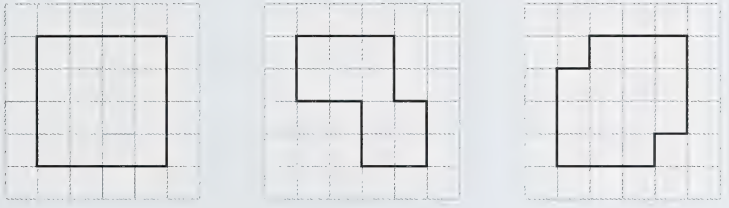
Bottom figure: area = 6 square units
perimeter = 14 units

b. Both figures have an area of 7 square tiles. The perimeter of the top figure is 16 units, which is greater than the perimeter of the bottom figure, which is 14 units.

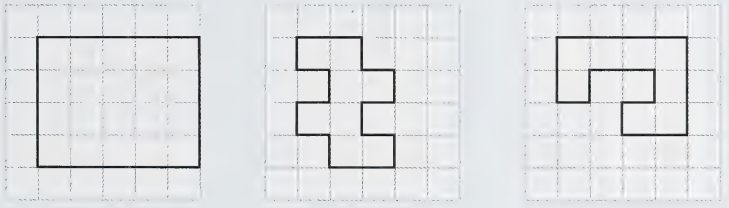
10. Textbook, page 215, Practise Your Skills, questions 1 and 2

1. Answers will vary. Sample answers are given.

a. Any figure with a perimeter of 16 units:

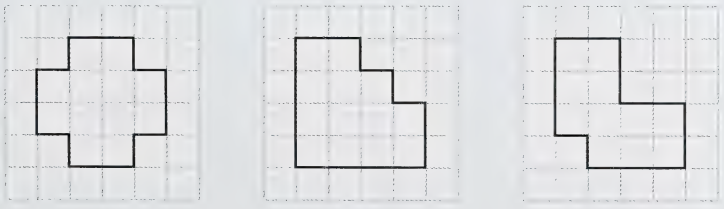


b. Any figure with a perimeter of 18 units:

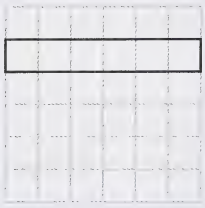
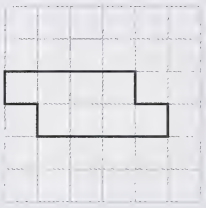
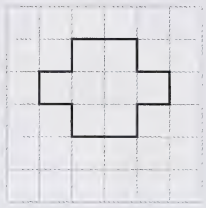


2. Answers will vary. Sample answers are given

a. Perimeter of 16 units and area not 6 square units:



b. Perimeter of 14 units and area not 7 square units:

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